

### 1. Free Space Path Loss (FSPL) Calculation:

The Free Space Path Loss (FSPL) was calculated using the formula:

- $FSPL (dB) = 20\log(d) + 20\log(f) + 20\log(4\pi/c)$  where:
- $d = \text{distance} = 2 \text{ km} = 2000 \text{ m}$
- $f = \text{frequency} = 5 \text{ GHz} = 5 \times 10^9 \text{ Hz}$
- $c = \text{speed of light} = 3 \times 10^8 \text{ m/s}$  Resulting in an FSPL of 112.44 dB.

### 2. Determine the received power at the receiver:

The received power ( $P_r$ ) at the drone's antenna was calculated using the link budget equation:

- $P_r(dBm) = P_t(dBm) + G_t(Db) + G_r(Db) - FSPL (Db) - L_{sys}(Db)$  where:
- $P_t = \text{transmitter power} = 0.5 \text{ W} = 27 \text{ dBm}$
- $G_t = \text{transmitter antenna gain} = 10 \text{ Db}$
- $G_r = \text{receiver antenna gain} = 12 \text{ Db}$
- $FSPL = \text{calculated Free Space Path Loss} = 112.44 \text{ Db}$
- $L_{sys} = \text{system losses} = 3 \text{ Db}$  The resulting received power is -66.45 dBm.

### 3. The Communication Link Reliability:

Comparing the calculated received power (-66.45 dBm) to the receiver sensitivity (-85 dBm), it is evident that the received power is significantly higher. Therefore, the communication link is considered reliable.